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February 23, 2004

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RE: U.S. Patent Application of L. Murray Dallas
Entitled: "Apparatus for Controlling a Tool Having a Mandrel that Must be Stroked Into or Out of a Well"
Serial No.: 10/727,806
Our Ref: 15912/09036

Dear Sir:

The following are being transmitted herewith:

1. Transmittal sheet (original plus 1 copy)
2. Submission of Certified Copy of Priority Document (1 sheet)
3. Canadian Certified Application
4. Return Postcard

Please charge any deficiency or credit any overpayment required by this action to our Deposit Account No. 50-1196, for which purpose an extra copy of this transmittal letter is attached.

Very truly yours,

Lloyd G. Farr
Reg. No. 38,446

I hereby certify that this paper and any referenced attachment and/or fee are being deposited with the U.S. Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Date of Deposit: February 23, 2004
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Typed name of person mailing paper or fee
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Signature

PATENT

DOCKET NO.: 15912/09036

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of L. Murray Dallas	)	Examiner: Unknown
	)	Art Unit: Unknown
Serial No.: 10/727,806	)	Account No.: 50-1196
Filed: December 4, 2003	)	
Title: "Apparatus for Controlling a Tool Having a Mandrel that Must be Stroked Into or Out of a Well"	)	

SUBMISSION OF CERTIFIED COPY OF PRIORITY DOCUMENT

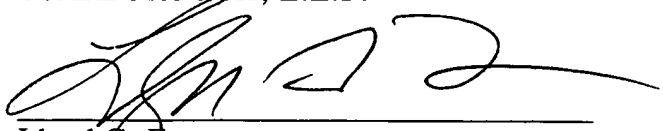
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Pursuant to Applicant's claim for priority to Canadian Application No. 2,421,348, filed March 7, 2003, for the above-referenced application, Applicant submits the attached certified copy of the Canadian application.

Respectfully submitted,

NELSON MULLINS RILEY &
SCARBOROUGH, L.L.P.



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This is to certify that the documents attached hereto and identified below are true copies of the documents on file in the Patent Office.

Specification and Drawings as originally filed, with Application for Patent Serial No: **2,421,348,** on March 7, 2003, by **L. MURRAY DALLAS,** for "Apparatus for Controlling a Tool Having a Mandrel that Must be Stroked Into or Out of a Well".

Agent certificateur/Certifying Officer

December 4, 2003
Date

Canada

OPIC CIPO

ABSTRACT OF THE DISCLOSURE

Apparatus for controlling a tool having a mandrel that must be stroked into or out of a well includes an anchor spool and a detachable superstructure. The anchor spool supports the detachable superstructure. The detachable superstructure includes at least two hydraulic cylinders used to stroke the mandrel into or out of the well.

APPARATUS FOR CONTROLLLING A TOOL HAVING A MANDREL THAT MUST BE STROKED INTO OR OUT OF A WELL

TECHNICAL FIELD

The present invention relates to equipment for servicing oil and gas wells and, in particular, to an apparatus for controlling a tool having a mandrel that must be stroked into or out of a high-pressure well.

BACKGROUND OF THE INVENTION

Most oil and gas wells eventually require some form of stimulation to enhance hydrocarbon flow in order to make or keep them economically viable. The servicing of oil and gas wells to stimulate production requires the pumping of fluids under high-pressure. The fluids are generally corrosive and abrasive because they are frequently laden with corrosive acids and abrasive propants such as sharp sand.

Wellheads are not designed to accommodate delivery of high-pressure, abrasive fluids into the well. Consequently, isolation tools in various forms and configurations have been invented to protect wellheads during well stimulation processes. As knowledge of well stimulation processes have developed, the importance of high delivery rates for successful and economic stimulation processes has been appreciated. Consequently, it is now common practice to run large bore mandrels through blowout preventers (BOPs) mounted to a

well in order to enhance stimulation effects and reduce job time.

Because of the very nature of the stimulation process, most wells to be stimulated have relatively low natural pressure before the stimulation process commences. There are, however, exceptions which may require high-pressure wells to be stimulated for various reasons. In any event, once stimulated, the well may be under very high pressure. The high pressure may result from the use of energized stimulation fluids, well known in the art, or natural pressure developed as a result of opening up a high pressure area of a production zone.

Consequently, situations exist in which the insertion of mandrels used to safely conduct high-pressure fluid through BOPs and other wellhead components or the removal of such mandrels from the wellhead requires mechanical control that cannot be provided by a service rig or a boom truck. For example, a well stimulated with energized fluid may overbear the weight of the mandrel with attached tools and tubing strings. In such situations, the well must be killed before a mandrel can be safely removed. As is well understood in the art, kill fluids are expensive and killing the well may reverse all or part of the beneficial effects of the stimulation process.

Consequently, there exists a need for an apparatus for controlling a tool having a mandrel that must be stroked into or out of a high-pressure well.

SUMMARY OF THE INVENTION

It is therefore an object of the invention to provide an apparatus for controlling a tool having a mandrel that must be stroked into or out of a high-pressure well.

It is a further object of the invention to provide an apparatus for controlling a plurality of different tools having a mandrel that must be stroked into or out of a high-pressure well.

The invention therefore provides an apparatus for controlling a tool having a mandrel that must be stroked into or out of a high-pressure well. The apparatus comprises an anchor spool adapted to be mounted in a fluid-tight seal to the top of a blowout preventer (BOP) on the high-pressure well. The anchor spool has a bottom flange for connecting to the BOP, an elongated sidewall, a top end with the threaded adapter for threaded connection of a packing retainer nut through which the mandrel reciprocates, and an anchor plate that extends laterally in at least two directions from the sidewall. The anchor plate is adapted to detachably receive RAM ends of at least two hydraulic cylinders. The apparatus further includes a detachable superstructure including at least two interconnected hydraulic cylinders for controlling movement of the tool. The detachable superstructure includes a tool support structure that interconnects a cylinder end of the respective hydraulic cylinders and includes an adapter stack with a top end adapted for connection of a fluid delivery conduit, a

bottom end for connection of the tool and a fluid passage in fluid communication with the top and bottom ends.

The tool support structure includes a control plate that interconnects cylinder ends of the at least two hydraulic cylinders. The control plate has a central passage located between the cylinder ends. The adapter stack includes a universal adapter mounted to the control plate in fluid communication with a central passage. A union adapter is mounted to a bottom side of the control pate in fluid communication with the central passage. The union adapter has a bottom end that terminates in a wing union adapted for connection to any one of a plurality of tool adapters respectively mounted to different tools having mandrels that must be stroked into or out of the high-pressure well.

The invention therefore provides an anchor spool mounted to a top of a BOP of a well to be stimulated. The anchor spool is used on every stimulation job in order to provide tool control, if required. The detachable superstructure is mounted to the anchor spool any time control of the tool is required. When high-pressure wells require stimulation, the detachable superstructure may be left on the wellhead during well stimulation without sacrificing any of the benefits of a fluid passage that communicates with a top of the wellhead isolation tool. In low-pressure situations, the detachable superstructure is only mounted to the anchor spool if, subsequent to stimulation, the wellbore is at high fluid pressures that require controlled removal of the mandrel from the wellhead.

BRIEF DESCRIPTION OF THE DRAWINGS

Further features and advantages of the present invention will become apparent from the following detailed description, taken in combination with the appended drawings, in which:

FIG. 1 is a schematic side elevational view of the apparatus in accordance with the invention for controlling a tool having a mandrel that must be stroked in or out of a high-pressure well;

FIG. 2 is a schematic side elevational view of the apparatus shown in FIG. 1 with a detachable superstructure of the apparatus detached from an anchor spool of the apparatus;

FIG. 3 is a schematic side-elevational view of the apparatus shown in FIG. 1 with a landing joint connected to a tool support structure of the apparatus, and the hydraulic cylinders in an extended condition;

FIG. 4 is a schematic side-elevational view of the apparatus shown in FIG. 3 with the hydraulic cylinders in a retracted condition;

FIG. 5 is a schematic slide-elevational view of the apparatus shown in FIG. 1 connected to a well stimulation tool, with the hydraulic cylinders in an extended condition; and

FIG. 6 is a side-elevational view of the apparatus shown in FIG. 5 with the hydraulic cylinders shown in a contracted condition.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The invention provides an apparatus for controlling a tool having a mandrel that must be stroked into or out of a high-pressure well. The apparatus comprises an anchor spool adapted to be mounted in a fluid-tight seal to a top of a blowout preventer (BOP) of the high-pressure well. The anchor spool has a bottom flange for connection to the BOP, an elongated sidewall, a top end with a threaded adapter for threaded connection of a packing retainer nut through which the mandrel reciprocates, and an anchor plate that extends laterally in at least two directions from the sidewall. The anchor plate is adapted to detachably receive RAM ends of at least two hydraulic cylinders. The apparatus further includes a detachable superstructure including at least two interconnected hydraulic cylinders for controlling movement of the tool. The detachable superstructure further includes a tool support structure that interconnects a cylinder end of the respective hydraulic cylinders and includes an adapter stack with a top end adapted for connection of a fluid delivery conduit, and a bottom end for connection to the tool. The adapter stack further includes a fluid passage in fluid communication with the top and bottom ends. The apparatus provides a convenient structure for controlling insertion or removal of a plurality of tools used for well stimulation operations.

FIG. 1 is a schematic side-elevational view of the apparatus 10 in accordance with the invention. The

apparatus 10 includes an anchor spool 12 and a detachable superstructure 26. The anchor spool 12 includes a bottom flange 14, an elongated sidewall 16, and a top end 17 with a threaded adapter 18 for threaded connection of a lock-down nut, as will be described below in more detail. Top end 17 also includes a packing cavity 20 for receiving and supporting a high-pressure packing, such a Chevron packing well known in the art. The anchor spool 12 further includes an anchor plate 22 that extends laterally in at least two directions from the elongated sidewall 16. The anchor plate 22 is preferably welded to an outer periphery of the elongated sidewall 16 and, in one embodiment, is reinforced by gussets 24 welded between the anchor plate 22 and the elongated sidewall 16 to provide additional stabilizing support. The anchor spool 12 is constructed to safely contain pressures of at least 15,000 psi.

The detachable superstructure 26 includes at least two hydraulic cylinders 28 having RAM ends 28a and cylinder ends 28b. The RAM ends 28a are detachably connected to the anchor plate 22 by threaded connectors 29, such as wing nuts, well known in the art. The RAM ends 28a of the hydraulic cylinders 28 are equipped with stabilizers 31 to increase the footprint of the RAM ends, and therefore provide additional stability between the anchor plate 22 and the hydraulic cylinders 28.

The cylinder ends 28b of the hydraulic cylinders 28 are rigidly interconnected by a tool support structure that includes a control pate 30. The control

pate 30 also supports an adapter stack 32. The adapter stack 32 includes a universal adapter 34 mounted to a union adapter 36. The union adapter 36 supports a wing union 38 used to connect a tool adapter 40. A fluid passage 42 extends through the tool adapter 40, the union adapter 36 and the universal adapter 34. The universal adapter 34 is received in a central passage in the control pate 30. The adapter stack 32 is mounted to the control pate 30 by bolts 44 received in bores through a flange 46 of the union adapter 36.

As shown in FIG. 2, when the threaded connectors 29 are removed from the RAM ends 28a of the hydraulic cylinders 28, the detachable superstructure 26 can be removed from the anchor spool 12. As will be understood by those skilled in the art, it is not unusual that a well to be stimulated has low natural pressure prior to the stimulation operation. Consequently, the anchor spool 12 can be used independently of the superstructure 26 when a well tool is inserted into a low-pressure well, since the weight of the tool with attached mandrel and, optionally, attached tubing string will overbear well pressure and the tool can be readily inserted into the well. However, the anchor spool is preferably used whenever well stimulation is performed to provide a means of controllably extracting the mandrel from the well if energized fluids are used for well stimulation and/or a high-pressure formation is opened up during the well stimulation process. When either situation occurs, the superstructure 26 is mounted to the anchor spool 12 and the hydraulic cylinders 28 are

operated to controllably stack the mandrel out of the well, so that a bottom of the mandrel is above a BOP to which the anchor spool is mounted. Once blind RAMs of the BOP are closed, pressure can be bled off from the anchor spool 12 using a pressure bleed port 48 in a manner well known in the art.

FIG. 3 is a schematic side-elevational view of the apparatus 10 in which the tool adapter 40 is connected to a landing joint 50 used to remove a tubing hanger from a tubing hanger spool of the well or insert the tubing hanger into the tubing hanger spool, as described in Applicant's Canadian patent application No. 2,338,097 which was laid open to public inspection on August 23, 2002. The landing joint 50 is optionally connected to the tool adapter 40 by a swivel joint 52. The tool adapter 40 is normally mounted to a tool adapter flange 41 connected to a top of the landing joint 50, or the optional swivel 52. Consequently, the landing joint 50 is connected to and disconnected from the detachable superstructure 26 using the wing union 38.

As shown in FIG. 3, a landing joint 50 extends through a lock-down nut 54 that engages the threaded adapter 18 on the top end of the anchor spool 12. The lock-down nut 54 secures a packing retainer nut 58, which in turn retains a Chevron packing 56 in a packing cavity 20 of the anchor spool 12. This permits the landing joint 50 to be reciprocated through the anchor spool 12 as it is stroked into and out of the well. As noted above, the use of the landing joint 50 is described

in detail in laid-open Canadian patent application No. 2,338,097.

FIG. 4 shows the landing joint 50 stroked down into the well to a position where it is connected to a top of the tubing hanger. After the landing joint is connected to the tubing hanger, the tubing hanger and connected tubing are raised into the anchor spool 12 using the hydraulic cylinders 28 in a manner well known in the art. Tubing RAMs of a BOP to which the anchor spool 12 is mounted are closed, pressure is bled off through the pressure relief port 47 in the anchor spool 12 and the apparatus 10 is hoisted by connecting a lifting sub to the universal adapter 34, and hoisting the entire apparatus along with the tubing hanger (not shown) and attached tubing (not shown) using a service rig, in a manner well known in the art.

FIG. 5 is a cross-sectional schematic view of the apparatus 10 in accordance with the invention mounted to a well stimulation tool described in Canadian Patent No. 2,303,058 which issued July 16, 2002 to the Applicant. The well stimulation tool 60 includes a fracturing head 62. The well stimulation tool 60 is connected to a top of the anchor spool 12 by a lock-down nut 54. The function and use of the well stimulation tool 60, referred as a blowout preventer protector in Applicant's issued Canadian Patent referenced above, is thoroughly explained in that patent. As shown in FIG. 5, a well stimulation tool 60 includes a mandrel 64 that is fully inserted through the wellhead and a cup tool 66

that is sealingly engaged with a casing of the well (not shown).

If energized fluids are used to stimulate the well or a high-pressure formation is opened up during the stimulation process, pressure in the well may be too high to safely remove the well stimulation tool 60 without the use of the apparatus 10 in accordance with the invention. Consequently, the superstructure 26 is connected to the anchor plate 22 using the threaded connectors 29 and the wing union 38 to connect the union adapter 36 to the tool adapter 40.

FIG. 6 shows the well stimulation tool 60 stroked out of the well using the apparatus 10. As is apparent, the hydraulic cylinders 28 are in an extended condition and the cup tool 66 is received within the anchor spool 12. Consequently, blind RAMs 72 of BOP 70 (FIG. 5) can be closed. Thereafter, pressure is bled from the anchor spool 12 using the pressure bleed valve 47, which permits the entire apparatus including the superstructure 26 and the anchor spool 12 to be removed from the BOP 70. Thereafter, fluid control equipment can be connected to a top of the BOP 70 and the stimulation fluids can be flowed back out of the well in a manner well known in the art.

As will be appreciated by those skilled in the art, wing union 38 permits different tools, such as the landing joint 50 (FIG. 3) and the well stimulation tool 60 (Fig. 5) to be rapidly connected and disconnected from the apparatus 10 in accordance with the invention. This makes the apparatus 10 very adaptable and permits a

plurality of well stimulation procedures to be performed. The apparatus 10 is adapted to be used to insert substantially any mandrel into a high-pressure well or remove the mandrel from the well. In fact, the apparatus 10 is also useful for low-pressure applications as will be well understood by those skilled in the art. The rapid connection and disconnection of different tools therefore provides a very versatile control mechanism adapted for use in a wide variety of applications.

The embodiments of the invention described above are intended to be exemplary only, the scope of the invention is therefore intended to be limited only by the scope of the appended claims.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. Apparatus for controlling a tool having a mandrel that must be stroked into or out of a high-pressure well, comprising in combination:

an anchor spool adapted to be mounted in a fluid-tight seal to a top of a blowout preventer (BOP) on the high-pressure well, the anchor spool having a bottom flange for connection to the BOP, an elongated sidewall, a top end with a threaded adapter for threaded connection of a packing retainer nut through which the mandrel reciprocates, and an anchor plate that extends laterally in at least two directions from the sidewall, the anchor plate being adapted to detachably receive ram ends of at least two hydraulic cylinders; and

a detachable superstructure including the at least two interconnected hydraulic cylinders for controlling movement of the tool, and a tool support structure that interconnects a cylinder end of the respective hydraulic cylinders and includes an adapter stack with a top end adapted for connection of a fluid delivery conduit, a bottom end for connection to the tool and a fluid passage in fluid communication with the top and bottom ends.

2. Apparatus for controlling a tool having a mandrel that must be stroked into or out of a high-pressure well, comprising in combination:

an anchor spool adapted to be mounted in a fluid-tight seal to a top of a blowout preventer (BOP) on the high-pressure well, the anchor spool having a bottom flange for connection to the BOP, an elongated sidewall, a top end with a threaded adapter for threaded connection of a packing retainer nut through which the mandrel reciprocates, and an anchor plate that extends laterally in at least two directions from the sidewall, the anchor plate being adapted to detachably receive ram ends of at least two hydraulic cylinders;

a control plate that interconnects cylinder ends of the at least two hydraulic cylinders, the control plate including a central passage located between the cylinder ends;

a universal adapter connected to a top side of the control plate in fluid communication with the central passage; and

a union adapter connected to a bottom side of the control plate in fluid communication with the central passage, the union adapter having a bottom end that terminates in a wing union adapted for connection to any one of a plurality of tool adapters respectively mounted

to different tools having mandrels that must be stroked into or out of a high-pressure well.

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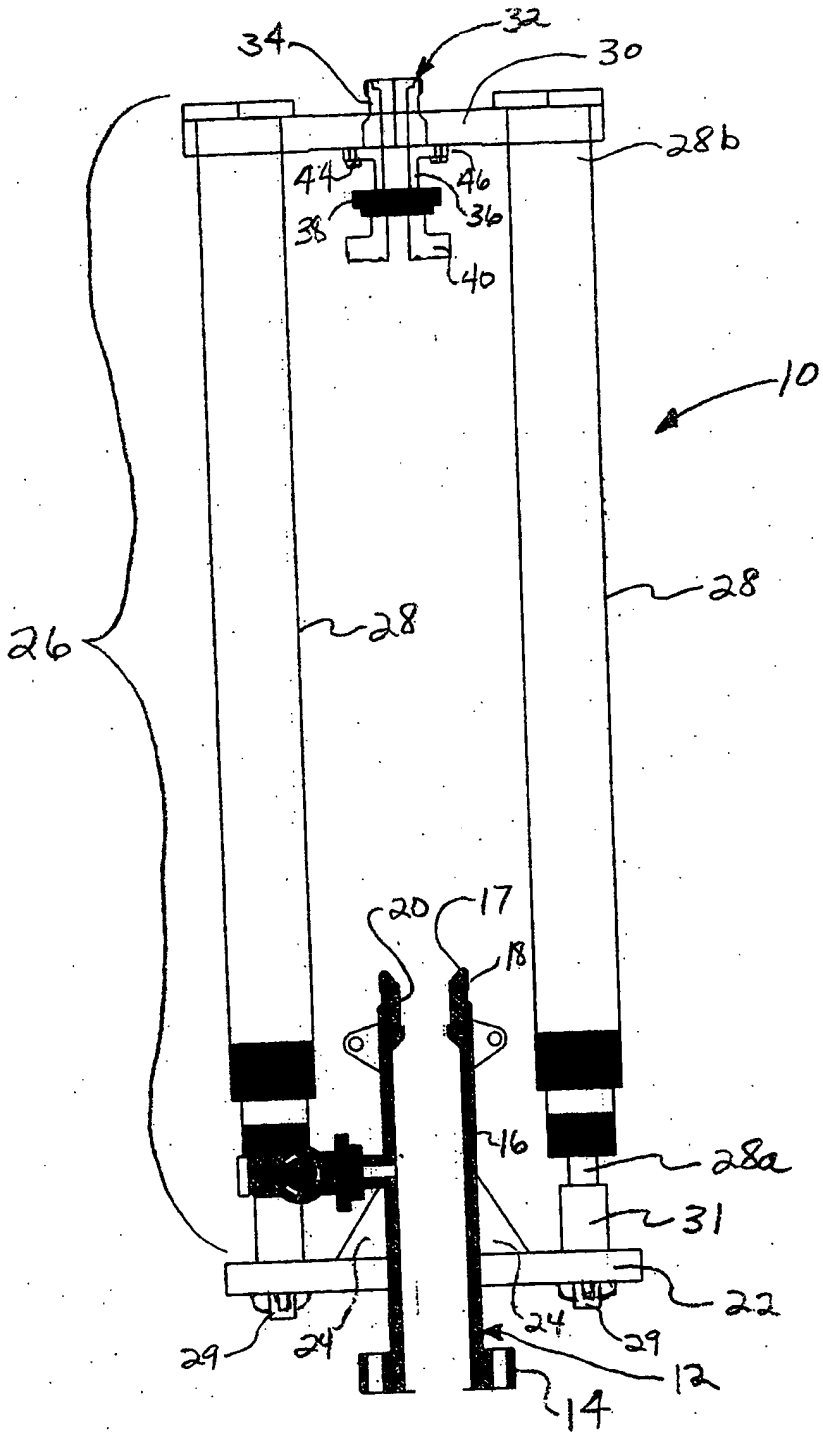
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FIG. 1

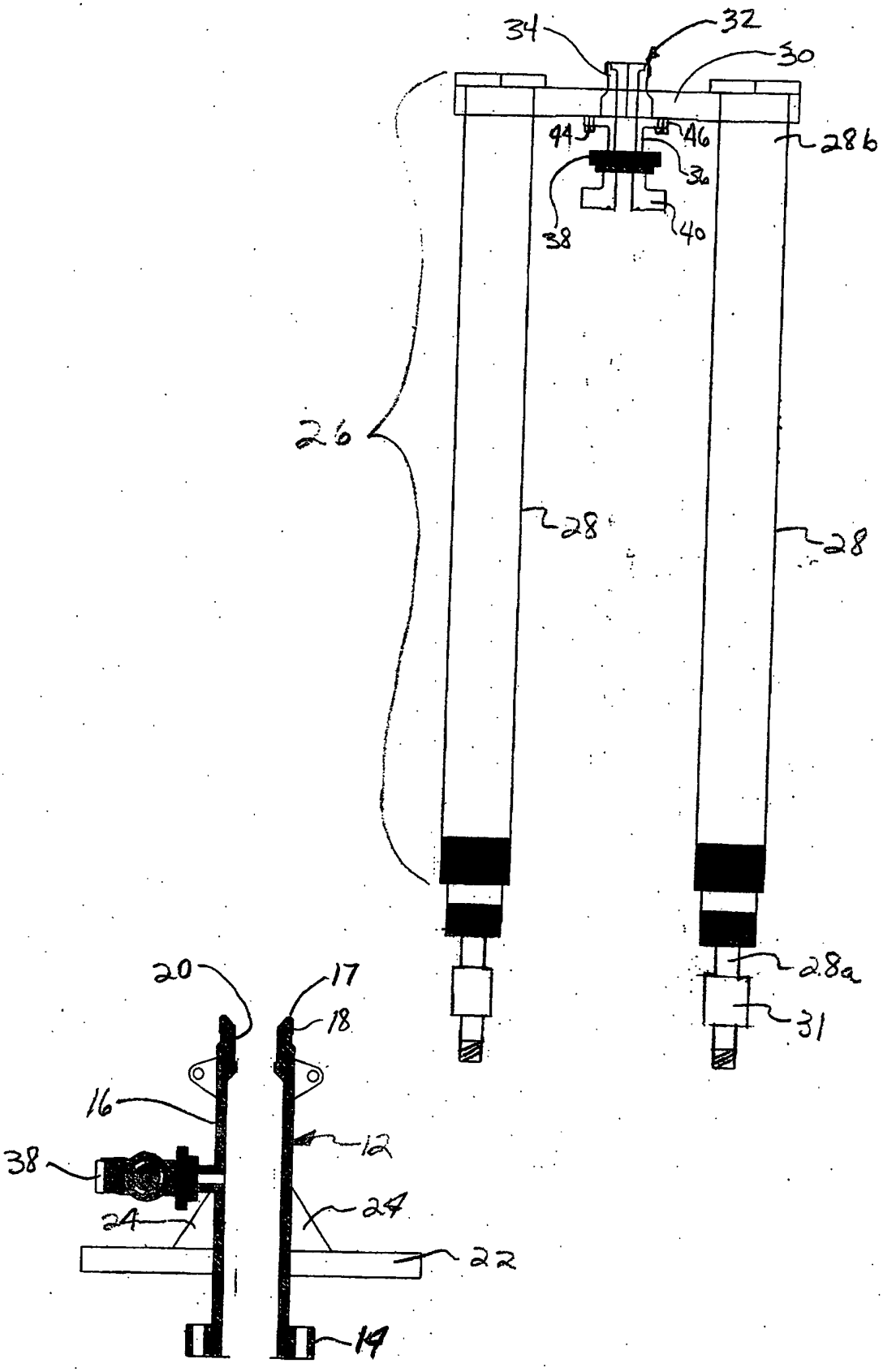
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FIG. 2

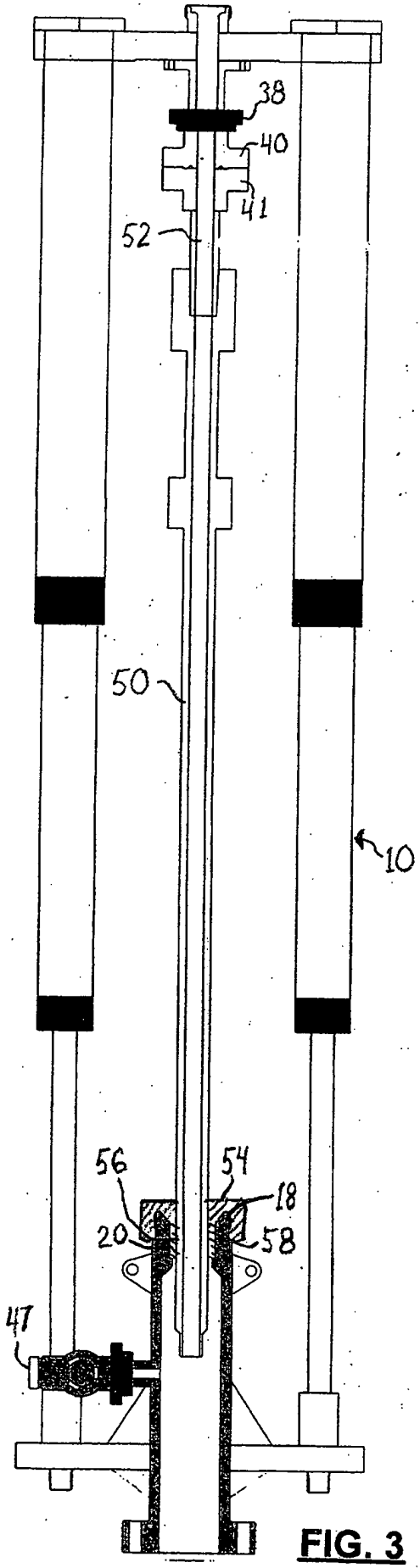
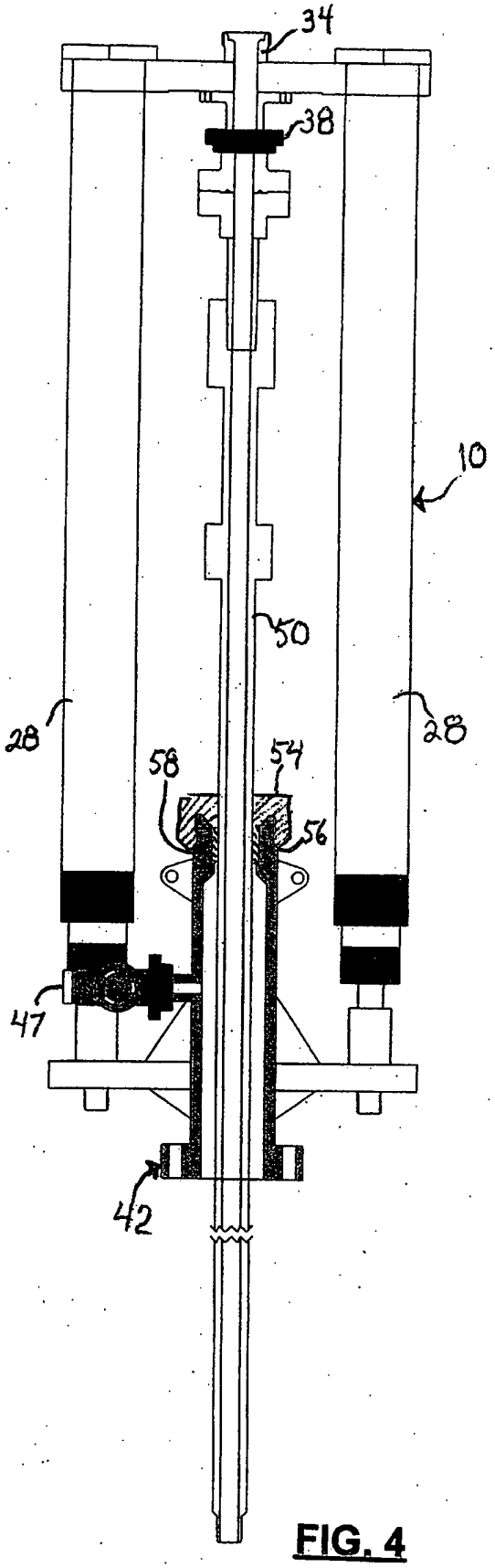


FIG. 3



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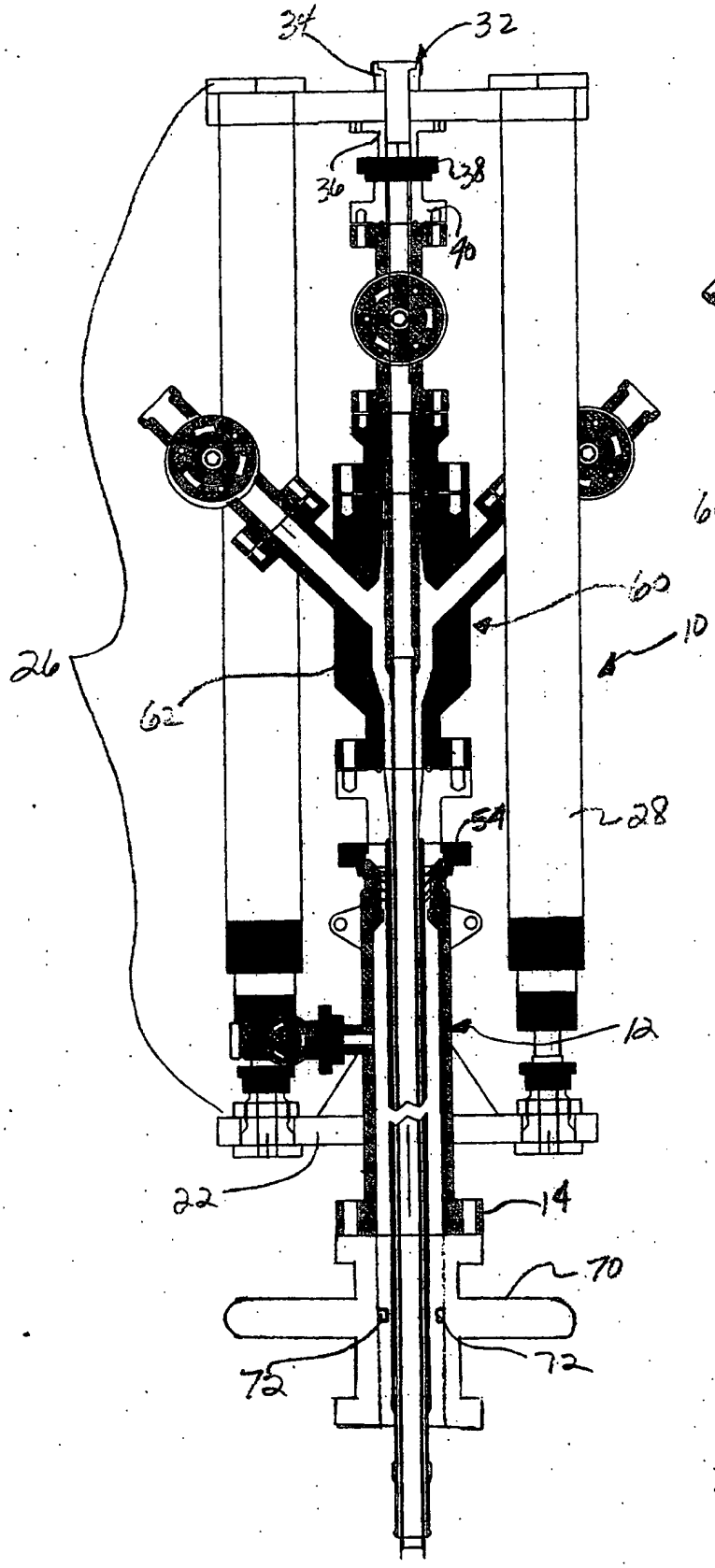
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FIG. 5

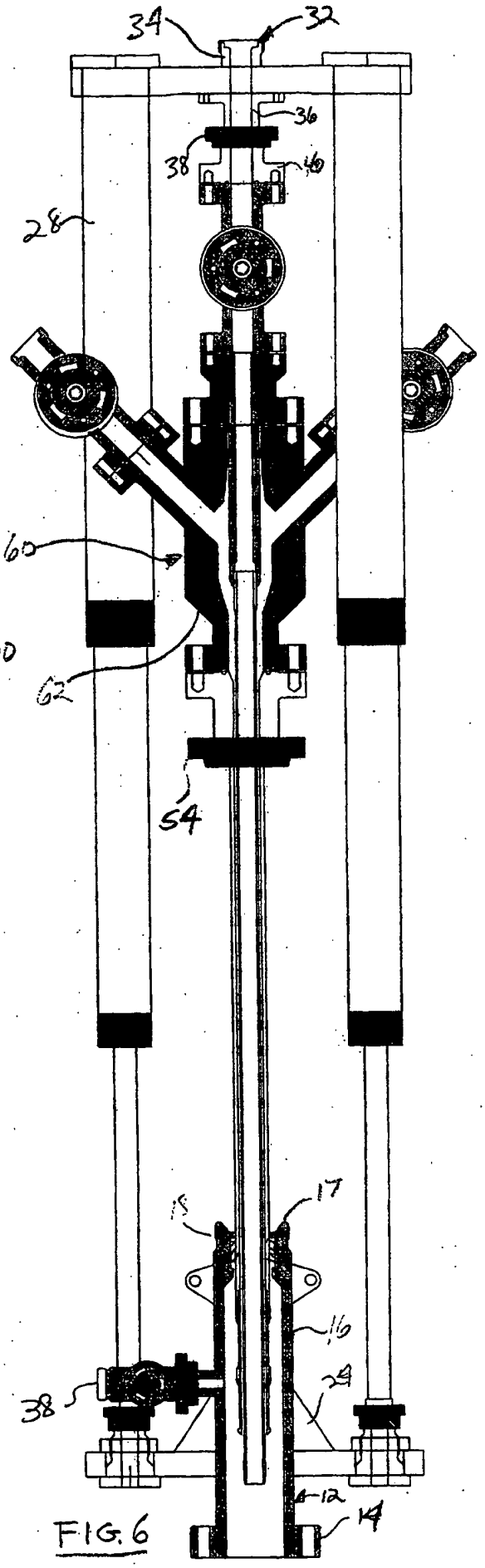
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FIG. 6